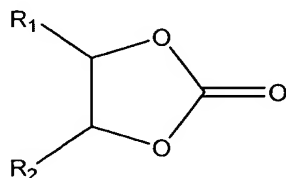


1 WHAT IS CLAIMED IS:

2 1. A process for preparing Group II metal carbonated, overbased Mannich
3 condensation products of alkylphenols which comprises:

4 forming a reaction mixture by combining a Mannich condensation
5 product of an alkylphenol wherein the alkyl group contains a sufficient
6 number of carbon atoms to render oil-soluble the resulting Group II
7 metal carbonated, overbased Mannich condensation products of
8 alkylphenol, a Group II metal oxide, hydroxide or C₁-C₆ alkoxide, one or
9 more promoters, and an alkylene carbonate selected from ethylene
10 carbonate or a mono-alkyl or di-alkyl substituted ethylene carbonate,
11 said alkylene carbonate having the following structure:



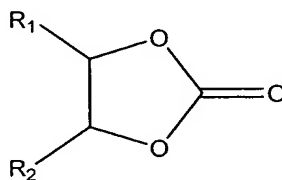
13 wherein R₁ and R₂ are independently hydrogen or alkyl containing one to
14 three carbon atoms; and wherein the combining is carried out for a time
15 and at a temperature sufficient to form in situ carbon dioxide and
16 alkylene glycol, or a reacting equivalent, to form a product comprising a
17 Group II metal carbonated, overbased Mannich condensation product of
18 an alkylphenol.

19 2. A process for preparing Group II metal carbonated, overbased Mannich
20 condensation products of alkylphenols which comprises:

21 forming a reaction mixture by combining a Mannich condensation
22 product of an alkylphenol wherein the alkyl group contains a sufficient
23 number of carbon atoms to render oil-soluble the resulting Group II
24 metal carbonated, overbased Mannich condensation products of

- 1 alkylphenol, a Group II metal oxide, hydroxide or C₁-C₆ alkoxide, one or
2 more promoters, and a C₂-C₁₀ alkylene glycol and carbon dioxide and
3 wherein the combining is carried out for a time and at a temperature
4 sufficient to form a product comprising a Group II metal carbonated,
5 overbased Mannich condensation product of an alkylphenol.
- 6 3. The process of claim 2 wherein the C₂-C₁₀ alkylene glycol is ethylene
7 glycol.
- 8 4. The process of claim 1 wherein the Mannich condensation product of an
9 alkylphenol is a Group II metal salt.
- 10 5. The process of claim 2 wherein the Mannich condensation product of an
11 alkylphenol is a Group II metal salt.
- 12 6. The process of claim 1 wherein the alkylene carbonate is added to the
13 reaction mixture over a time period of about 15 minutes to about
14 120 minutes.
- 15 7. The process of claim 6 wherein the alkylene carbonate is added to the
16 reaction mixture over a time period of about 30 minutes to about
17 90 minutes.
- 18 8. The process of claim 1 wherein one of R₁ and R₂ is hydrogen and the
19 other is hydrogen or methyl.
- 20 9. The process of claim 1 wherein the alkylene carbonate is ethylene
21 carbonate.
- 22 10. The process of claim 1 wherein the promoter comprises a C₂-C₁₀
23 alkylene glycol.

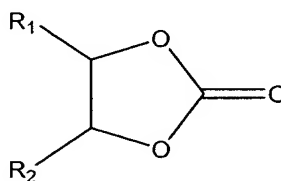
- 1 11. The process of claim 1 wherein a second promoter comprises water, a
2 C₁-C₅ mono- or di-alcohol, ethylene glycol or a mixture thereof.
- 3 12. The process of claim 1 further comprises recovering the product by
4 filtering the reaction mixture to remove sediment.
- 5 13. A process for preparing Group II metal carbonated, overbased Mannich
6 condensation products of alkylphenols which comprises the steps of:
- 7 (a) forming a reaction mixture by combining a Mannich condensation
8 product of an alkylphenol wherein the alkyl group contains a
9 sufficient number of carbon atoms to render oil-soluble the
10 resulting Group II metal overbased Mannich alkylphenol, and one
11 or more promoters, and a Group II metal oxide, hydroxide or C₁-C₆
12 alkoxide; and
- 13 (b) contacting said reaction mixture with an alkylene carbonate
14 selected from ethylene carbonate or a mono-alkyl or di-alkyl
15 substituted ethylene carbonate, said alkylene carbonate having the
16 following structure:



- 18 wherein R₁ and R₂ are independently hydrogen or alkyl containing
19 one to three carbon atoms; and wherein the contacting is carried
20 out for a time and at a temperature sufficient to form in situ carbon
21 dioxide and alkylene glycol, or a reacting equivalent, to form a
22 product comprising a Group II metal carbonated-overbased
23 Mannich condensation product of an alkylphenol.

- 1 14. The process of claim 13 wherein the Mannich condensation product of
2 an alkylphenol is a Group II metal salt.
- 3 15. The process of claim 13 wherein in step (b) the alkylene carbonate is
4 added to the reaction mixture over a time period of about 15 minutes to
5 about 120 minutes.
- 6 16. The process of claim 15 wherein in step (b) the alkylene carbonate is
7 added to the reaction mixture over a time period of about 30 minutes to
8 about 90 minutes.
- 9 17. The process of claim 13 wherein in step (b) one of R₁ and R₂ is
10 hydrogen and the other is hydrogen or methyl.
- 11 18. The process of claim 13 wherein in step (b) the alkylene carbonate is
12 ethylene carbonate.
- 13 19. The process of claim 13 wherein in step (a) the promoter is a C₂-C₁₀
14 alkylene glycol.
- 15 20. The process of claim 13 wherein in step (b) the second promoter
16 comprises water, a C₁-C₅ mono- or di-alcohol, ethylene glycol or a
17 mixture thereof.
- 18 21. The process of claim 13 further comprising:
- 19 (c) recovering the product by filtering the reaction mixture of step (b) to
20 remove sediment.
- 21 22. A process for preparing Group II metal carbonated, overbased Mannich
22 condensation products of alkylphenols which comprises the steps of:

- 1 (a) forming a first reaction mixture by combining an alkylphenol
2 wherein the alkyl group contains a sufficient number of carbon
3 atoms to render oil-soluble the resulting Group II metal carbonated,
4 overbased Mannich condensation products of alkylphenol with an
5 aldehyde and an amine, in the presence of an inert hydrocarbon
6 diluent;
- 7 (b) contacting said first reaction mixture with a second reaction mixture
8 comprising a Group II metal oxide, hydroxide or C₁-C₆ alkoxide,
9 and a promoter to form a third reaction mixture; and
- 10 (c) contacting said third reaction mixture with an alkylene carbonate
11 selected from ethylene carbonate or a mono-alkyl or di-alkyl
12 substituted ethylene carbonate, said alkylene carbonate having the
13 following structure:



- 15 wherein R₁ and R₂ are independently hydrogen or alkyl containing
16 one to three carbon atoms; and wherein said contacting is carried
17 out for a time and at a temperature sufficient to form in situ carbon
18 dioxide and alkylene glycol, or a reacting equivalent, to form a
19 product comprising a Group II metal carbonated, overbased
20 Mannich condensation product of an alkylphenol.
- 21 23. The process of claim 22 wherein in step (c) the alkylene carbonate is
22 added to the third reaction mixture over a time period of about
23 15 minutes to about 120 minutes.

- 1 24. The process of claim 23 wherein in step (c) the alkylene carbonate is
2 added to the third reaction mixture over a time period of about
3 30 minutes to about 90 minutes.
- 4 25. The process of claim 22 wherein in step (c) one of R₁ and R₂ is
5 hydrogen and the other is hydrogen or methyl.
- 6 26. The process of claim 22 wherein in step (c) the alkylene carbonate is
7 ethylene carbonate.
- 8 27. The process of claim 22 wherein in step (b) the promoter is a C₂-C₁₀
9 alkylene glycol.
- 10 28. The process of claim 22 wherein step (a) further comprises a promoter,
11 wherein the promoter comprises water, a C₁-C₅ mono- or di-alcohol,
12 ethylene glycol or a mixture thereof.
- 13 29. The process of claim 22 wherein in step (a) the amine is an aliphatic
14 amine, an aromatic amine, a polyfunctional amine or mixtures thereof,
15 containing at least one amino group characterized by the presence of at
16 least one active hydrogen or methylene group, and wherein the amine
17 contains only primary amino groups, only secondary amino groups, or
18 both primary and secondary amino groups.
- 19 30. The process of claim 29 wherein the aliphatic amine is an alkylene
20 diamine, a dialkylamine, a polyalkylene polyamine or mixtures thereof.
- 21 31. The process of claim 30 wherein the aromatic amine is a single-ring
22 aromatic amine, a double-ring aromatic amine or mixtures thereof.
- 23 32. The process of claim 22 wherein in step (a) the aldehyde is an aliphatic
24 aldehyde, aromatic aldehyde, a heterocyclic aldehyde or mixtures
25 thereof.

- 1 33. The process of claim 32 wherein the aliphatic aldehyde is formaldehyde
2 or paraformaldehyde.
- 3 34. The process of claim 33 wherein the aromatic aldehyde is
4 benzaldehyde.
- 5 35. The process of claim 33 wherein the heterocyclic aldehyde is furfural.
- 6 36. The process of claim 22 wherein the molar ratios of the alkylphenol, the
7 aldehyde and the amine are from about 1:1.8:1 to about 1:3:1.
- 8 37. The process of claim 22 further comprising:
- 9 (d) recovering the product by filtering the third reaction mixture of
10 step (c) to remove sediment.
- 11 38. The process of claim 22 wherein the alkyl group of the alkylphenol is a
12 straight-chain alkyl group or branched-chain alkyl group containing at
13 least 10 carbon atoms.
- 14 39. The process of claim 38 wherein the straight-chain alkyl group or the
15 branched-chain alkyl group contains from about 12 carbon atoms to
16 about 50 carbon atoms.
- 17 40. The process of claim 38 wherein the alkyl group of the alkylphenol
18 contains from about 25 to about 100 mole percent predominantly
19 straight-chain alkyl groups containing from about 15 to about 35 carbon
20 atoms and from about 75 to about 0 mole percent branched-chain alkyl
21 groups containing from about 9 to about 18 carbon atoms.
- 22 41. The process of claim 40 wherein the alkyl group of the alkylphenol
23 contains from about 40 to about 70 mole percent predominantly
24 straight-chain alkyl groups containing from about 15 to about 35 carbon

- 1 atoms and from about 60 to about 30 mole percent branched-chain alkyl
2 groups containing from about 9 to about 18 carbon atoms.
- 3 42. The process of claim 22 wherein the alkyl group of the alkylphenol is
4 attached predominantly at the para position of the phenol ring.
- 5 43. The process of claim 42 wherein the alkylphenol containing the para
6 attachment of the alkyl group is from about 70 to about 95 weight
7 percent of the total alkylphenol.
- 8 44. The process of claim 22 wherein the Group II metal oxide, hydroxide or
9 C₁-C₆ alkoxide is selected from the group consisting of calcium, barium,
10 and magnesium oxide, hydroxide or C₁-C₆ alkoxide and mixtures
11 thereof.
- 12 45. The process of claim 44 wherein the Group II metal oxide, hydroxide or
13 C₁-C₆ alkoxide is calcium hydroxide.
- 14 46. A product made by the process of claim 1 wherein the CO₂ to Ca ratio of
15 the product is in the range of about 0.01 to about 0.6.
- 16 47. A product made by the process of claim 13 wherein the CO₂ to Ca ratio
17 of the product is in the range of about 0.01 to about 0.6.
- 18 48. A product made by the process of claim 22 wherein the CO₂ to Ca ratio
19 of the product is in the range of about 0.01 to about 0.6.
- 20 49. A detergent-dispersant antioxidant additive comprising a Group II metal
21 carbonated, overbased Mannich condensation products of alkylphenols,
22 said product additive having a CO₂ to Ca ratio in the range of about 0.01
23 to about 0.6.

- 1 50. The detergent-dispersant antioxidant additive of claim 49 having a CO₂
2 to Ca ratio in the range of about 0.3 to about 0.5.
- 3 51. A detergent-dispersant antioxidant additive comprising a Group II metal
4 carbonated, overbased Mannich condensation products of alkylphenols
5 wherein the Mannich condensation products of alkylphenol is a
6 condensation product of an alkylphenol, an aldehyde and an aliphatic
7 amine, an aromatic amine, a polyfunctional amine or mixtures thereof,
8 said additive having a CO₂ to Ca ratio is in the range of about 0.01 to
9 about 0.6.
- 10 52. The detergent-dispersant antioxidant additive of claim 51 wherein said
11 product additive has a CO₂ to Ca ratio in the range of about 0.3 to about
12 0.5.
- 13 53. A Mannich condensation product comprising a reaction product of an
14 alkylphenol, an aldehyde and N-phenyl-1,4-phenylene diamine.
- 15 54. The product of claim 53 wherein the alkyl group of the alkylphenol is a
16 straight-chain alkyl group or branched-chain alkyl group containing from
17 about 10 carbon atoms to about 50 carbon atoms.
- 18 55. The product of claim 54 wherein the alkyl group of the alkylphenol has
19 about 12 carbon atoms to about 24 carbon atoms.
- 20 56. The product of claim 53 wherein the aldehyde is an aliphatic aldehyde,
21 aromatic aldehyde, a heterocyclic aldehyde or mixtures thereof.
- 22 57. The product of claim 56 wherein the aliphatic aldehyde is
23 paraformaldehyde or formaldehyde.

- 1 58. The product of claim 53 wherein the alkyl group of the alkylphenol has
- 2 about 12 carbon atoms, the aldehyde is paraformaldehyde, and the
- 3 amine is N-phenyl-1,4-phenylene diamine.